Seychelle Environmental Technologies, Inc. – Survivor™ Portable Water Purification Bottle

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Device Information

The Seychelle Environmental Technologies, Inc., Survivor Portable Water Purification Bottle is a handheld sports type squeeze bottle. The bottle has a capacity of 0.71 L (24 oz.). The bottle contains a filter cartridge consisting of an activated carbon block depth filter that is connected to the drink spout by flexible tubing and sits near the bottom of the sports bottle. The activated carbon filter is a 6 cm long hollow-core filter with a 0.6 cm thick wall. There is a final coarse filter inside the hollow core where water exits the filter cartridge to the flexible tubing. Water flows from outside through the activated carbon block filter wall into the hollow inside, through the coarse filter and into the flexible tubing connected to the drink spout. The carbon block filter has a 2 µm pore size rating. Information provided by Seychelle claims this device removes or reduces 99.9% (3-log) *Cryptosporidium* oocysts and 99.99% (4-log) *Giardia* cysts, as well as various inorganic and organic chemical contaminants. Seychelle offers a silver-impregnated carbon block filter for use with its water bottles. It is unclear whether the carbon block filter with this device is silver impregnated and should be assumed not to be. The silver impregnation is designed to limit microbial growth on the filter and is not expected to increase reduction of contaminants from the bulk water. Directions for use require the user to fill the bottle with water and squeeze to produce water. Prior to the first use the filter must be flushed with two full bottles of water to remove filter particle fines. When storing the device, Seychelle recommends the filter be flushed with a chlorine solution (2 drops chlorine to 1 bottle water) and allowed to dry. The above mentioned treatment and device is identical to the Seychelle Flip-Top Water Bottle. What makes the Seychelle Survivor Purification Bottle different is the additional chlorine tablets [U.S. Environmental Protection Agency (USEPA) Reg. No. 55304-4-71426, Est. No. 76762-PA-1] included to be used if viruses are suspected in the source water. Instructions state to take 1 of 5 included tablets that are scored in quarters, break off 1 quarter and place it in 1 full bottle of water (24 oz). The user should then wait 15 minutes prior to consumption. The manufacturer markets this device with a filter capacity of 560 L and enough chorine tablets to treat 94 L. The 5 chlorine tablets included will treat, as directed, 20 bottles full of water equaling 14 L (0.71 L/bottle x 5 tablets x 4 doses per tablet), not the 94 L stated by the manufacturer. Instruction state to not allow bottle to freeze, as that may damage the bottle and/or

filter. Additional items included with this device are an emergency thermal blanket, compass, and whistle, all of which fit into, or attached to, the water bottle insulated jacket.

Effectiveness Against Microbial Pathogens

No data was received showing the effectiveness of this product with respect to the USEPA Guide Standard Protocol for Testing Microbiological Water Purifiers (reference 1). The theory and practice of depth filtration has been widely studied and there has been significant research conducted on activated carbon block filtration (reference 2). In the absence of data specific to this device tested using reference 1, and based on general knowledge of depth and carbon block filtration, this device should be capable of consistently reducing *Giardia* cysts and *Cryptosporidium* oocysts to the required minimum log reductions stated in reference 1 (e.g., 3-log) when used as directed. It is not expected to consistently reduce bacteria (6-log). No information is given on the chemical composition or the disinfectant concentration received from each dose when using the included chlorine tablets. Because of this, it is unclear whether the dose is adequate to reduce viruses to the requirements of reference 1. Based on general depth and carbon block filtration information, the Survivor Purification Bottle is assigned one √ each for the reduction of *Giardia* cysts and *Cryptosporidium* oocysts and one X each for bacteria and virus reduction (for an explanation of the rating checks click here).

Table. Expected Performance Against Microbial Pathogens.

Microbial Pathogen Type	Expected Disinfection Capability	Evaluation Rating	Primary Pathogen Reduction Mechanism
Bacteria	> 6-log	X	-
Viruses	> 4-log	X	-
Giardia cysts	> 3-log	√	size exclusion
Cryptosporidium oocysts	> 3-log	√	size exclusion

Production Rate and Capacity

Inherent to the production rate and capacity of filtration devices is the quality of the raw water source. Because it is a squeeze bottle, the actual production rate is dependent on the user. The production capacity is stated by the manufacturer to be up to 560 L for the filter and 94 L for the chlorine tablets. As explained above, based on the instructions, the chlorine tablets will only

dose 14 L. Since the chlorine tablets are a critical component of the device, the overall capacity should be considered 14 L. As stated in the device instructions, production capacity will vary widely with raw water quality (e.g., turbidity). There is a 15 minute wait time prior to consumption when using the chlorine tablets.

Cleaning, Replacement, and End of Life Indicator

This device cannot be backwashed to remove sediment from the filter. When the device becomes unusable due to decreased production rate, the clogged filter must be replaced. The bottle can be hand washed. For practical purposes, the filter cartridges are not cleanable. The device contains no end of life indicator short of filter clogging or after using all of the chlorine tablets.

Weight and Size

Dry weight	300 grams
Size (height x diameter)	25 cm x 7 cm

Cost

Survivor Bottle (with chlorine tablets and accessories)	$35.00
Replacement filter	$15.00
Replacement chlorine tablets (5 count)	$ 1.50

Device Evaluation

No data was received that challenged the Survivor Portable Water Purification Bottle against reference 1. General research on depth and carbon block filtration indicates that this device should be capable of consistently reducing *Giardia* cysts and *Cryptosporidium* oocysts. Since no information is given regarding the chlorine tablet composition or concentration of the instructed dose, adequate reduction/inactivation of bacteria and viruses cannot be assumed. Additional treatment or clarification of the manufacturer recommended treatment is necessary to reduce bacteria and viruses, such as adding a disinfectant (e.g., chlorine, iodine, chlorine dioxide) to the bottle prior to filtering. The chlorine tablet packaging contains an expiration date, after which the tablets should not be used. Care must be taken when unpackaging the chlorine tablets from the blister-pack, so as not to break them into the wrong size. Care also should be taken after handling the tablets to avoid chlorine exposure to the skin and eyes. It is unclear whether the carbon block filter is silver impregnated. If it is, then there is a possibility that silver can leach from the silver-impregnated cartridge filter and be consumed. Although no data was received evaluating the potential for silver leaching, it is not likely that using this device for short periods

would cause any adverse health effects due to silver ingestion. The activated carbon should remove tastes and odors from the source water as well as from any disinfectant used prior to filtration. This device, like all filters with small pore sizes, is highly affected by turbid (cloudy) waters. Since the device is not able to be backwashed to remove accumulated particulates, once clogged, the filter must be replaced. There is no indicator of process failure or end of device useful life.

Advantages

- Expected to consistently provide adequate protection from *Giardia* cysts and *Cryptosporidium* oocysts, although device-specific testing data using the USEPA Protocol is not available.
- Simple and effective for cysts.
- Provides taste and odor reduction.

Disadvantages

- Not expected to be consistently effective against bacteria and viruses.
- Reduced production capacity when using high turbidity water.
- Not backwashable.
- No real-time indicator of process failure.

References

1. USEPA, 1989. Guide Standard and Protocol for Testing Microbiological Water Purifiers. *Federal Register*. 54:34067.

2. U.S. Army Center for Health Promotion and Preventive Medicine, 2005. *Technical Information Paper; Filtration in the Use of Individual Water Purification Devices,* Aberdeen Proving Ground, MD.